

auto-transformer which is connectable across a 110 volt alternating current source.

Positioned within vacuum chamber 11 is a container 21 constructed in accordance with the present invention. Container 21 is connected to another source of electrical energy 20', which is preferably of a type to supply a high current at low voltage, by means of leads 22 and 23. As illustrated in Fig. 1, container 21 comprises a resistance heated container. It is, however, to be expressly understood that container 21 may be heated indirectly as well as by means of passing an electrical current therethrough.

Container 21 in its presently preferred embodiment, as shown in Fig. 2, comprises a member of heat conducting material, a recess 31 is provided along a portion of the surface thereof which is adapted to receive a cover or cap 32 as illustrated in Fig. 3. Slideable clamps 33 are provided for retaining cover 32 in place as herein-after more fully described. The surface of container 21 defines an orifice therein as shown at 34 in Fig. 2. Orifice 34 extends from the recessed portion 31 through the opposite side of container 21 as more clearly shown in Fig. 4. Also provided within container 21 is a plurality of cavities 35 spaced along the length of the container. The number of cavities is determined by the amount of material to be deposited and the surface area to be covered and, therefore, may be as few as one, there being no upper limit. Web 36 separating the cavities from the orifice is recessed along the top surface thereof as more clearly shown in Fig. 4 to provide direct communication between each cavity and the orifice 34. Although it is not deemed necessary, a rib 37 is provided between the outer wall of container 21 and the interior thereof in order to provide structural strength to container 21, thereby making it more rugged in construction and thus better adapted for utilization in production techniques.

In order to further illustrate the utility of the present invention, the operation of the apparatus of Fig. 1 will be further described in conjunction with the formation of an ohmic contact by depositing a layer of molten gold upon a semiconductor body. With the bell jar 12 removed, a semiconductor body 45 is placed upon resistance heating platform 16, particles of gold 41 and 42 are placed within cavities 35 of container 21 as shown in Fig. 5. In a typical example for providing an ohmic contact to a silicon crystal a container having twelve cavities distributed along its length may be used. About 2.7 grams of gold would be distributed evenly in each of the twelve cavities. The specific amount of material to be used in any particular application is dependent upon the surface area to be coated and the thickness of material to be deposited. Cover 32 is then placed within recess 31 and clamps 33 are positioned so as to retain cover 32 in place. Container 21 is then placed within chamber 11 and electrical connection made thereto. In the presently preferred embodiment of the apparatus as shown in Fig. 1, container 21 may be held in place by clamps which also provide the electrical connection and at the same time allow container 21 to be adjusted in such a manner that the orifice is disposed in a downward direction towards semiconductor body 45. Container 21 is positioned above the upper surface of the body 45 as shown in Fig. 1. The distance between the upper surface of body 45 and container 21 is not critical and may vary depending upon the particular design considerations involved in each application.

Bell jar 12 is then placed upon base 13 and the chamber 11 sealed by means of gaskets 24 and chamber 11 is then evacuated. Current is applied to resistance heating platform 16 from source of electrical energy 20 to raise it to the necessary temperature. After the heating platform has attained the required temperature current is passed through container 21 to raise it to a temperature sufficient to melt and evaporate the gold as shown in

Fig. 5. In practice using a container 21 made of carbon approximately $\frac{3}{8}$ inch in diameter, approximately 300 amperes of current are passed through container 21 until the surface thereof between clamps 33 appears to be bright yellow in color indicating a probable temperature for the container of more than 1250° C. At such a temperature the gold will become molten and will then pass into the vapor state thus leaving the cavities and being projected through the orifice as shown at 42 in Fig. 5 upon the surface of semiconductor body 45. The temperature is maintained for a time sufficient to evaporate the desired amount of gold upon the surface of body 45, utilizing the material and container above referred to. If the temperature is maintained for approximately 10 minutes, it has been found that approximately 115 milligrams of gold per square inch of surface area will be deposited. When the gold evaporates and is deposited upon the surface of semiconductor body 45 to the desired depth, the semiconductor body is cooled to form the ohmic connection thereto.

Although a carbon filament was illustrated in connection with the apparatus of Fig. 1 for evaporating gold upon the semiconductor body, it will be apparent to those skilled in the art that many other materials may be utilized for the container as illustrated. The considerations which must be made in choosing a material for the container are as follows: the melting point of the container material must be greater than the melting point of the material to be deposited upon the desired surface and in some applications, such as evaporation of metal upon the surface of semiconductor bodies, the material of the container must be chosen so as to prevent the introduction of undesired contaminants into chamber 11.

It should be further understood that many modifications of the internal structure of container 21 may be made without variation from the scope of the present invention. As an example, an alternative embodiment of a container in accordance with the present invention is illustrated in Figs. 6 through 8.

Referring now more particularly to Fig. 6 there is shown a container 51 having cavities 52 disposed therein. A cap 53 retained by clamps 54 is utilized to cover cavities 52 during the evaporation of material therefrom. Communicating with cavities 52 is an orifice 55 more clearly illustrated in Fig. 7. As shown in Fig. 7, cavities 52 may be disposed on opposite sides of orifice 55 and in staggered relationship with each other. As more clearly shown in Fig. 8, cavities 52 are disposed at an angle with respect to orifice 55. In practice particles 56 of metal to be vapor deposited upon a desired surface are placed within cavities 52 as shown in Fig. 8. Cap 53 is then placed upon container 51 and clamps 54 positioned to retain it firmly in place. As hereinabove described, the temperature of container 51 is raised first above the melting point of the material to be evaporated and maintained there until the material within cavities 52 becomes molten. The temperature of the container is thereafter raised above the evaporation temperature of the material to thus evaporate material 56 causing it to pass from the cavities 52 and through the orifice 55 communicating therewith in a downward direction upon the surface of the material to be coated.

There has thus been described a container for evaporating material in relatively thick and uniform layers upon a surface to be coated therewith which is capable of retaining large amounts of the materials to be evaporated and of depositing said material in a predetermined direction upon the surface to be coated while at the same time eliminating dropping of the molten material prior to evaporation thereof.

What is claimed is:

1. In a system for evaporating a material upon the surface of a body to be coated therewith, a container for vaporizing said material and directing it toward said body, said container comprising; an elongated member